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10/689,365	10/20/2003	Mark Beaumont	DB001062-000	4385

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EXAMINER
KAWSAR, ABDULLAH AL

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

MN

Office Action Summary	Application No.	Applicant(s)	
	10/689,365	BEAUMONT, MARK	
	Examiner	Art Unit	
	Abdullah-Al Kawsar	2109	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10/20/2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/20/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-33 are pending.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No.10/689,365, filed on 10/23/2003.

Information Disclosure Statement

3. The information disclosure statement filed 10/20/2003 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1, 20 and 26 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. As per claims 1 and 20 it recites some balancing steps but does not produce any tangible result as the system being balanced at the end of the process and the steps are also directed to computer program per se representing functional descriptive material without a computer of computer readable medium.

6. Claims 26 recites a "memory device" however, it appears that the system would reasonably be interpreted by one of the ordinary skill in the art as software per se failing to be tangibly embodied or included any recited hardware as part of the system also carrying a set of instructions does not defined it is being stored on the memory device it could be only a in transition through the memory device.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 1-33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. The following terms are not clearly understood:

i. Claims 1 and 33 recites in lines 5-6 "balancing at least one line of processing elements in the first dimension; balancing at least one line of

processing elements in a next dimension;" it is not clear how the balancing is being done and how the dimension is being defined.

ii. Claim 20 recites in lines 5-7 recites "whereing each of said balanced lines includes one of X local number of tasks and (X+1) local number of tasks" it is unclear how its balanced to be having only values of X and X+1 also in line 12-13 recites "shifting said values for each processing element within said balanced lines until a sum of said processing elements relative to a second dimension has only two values" it is unclear how the sum of processing elements relative to a second dimension has two values.

iii. Claims 2 and 22 in lines 9-10 recite, "calculating a local mean number of tasks within each of said plurality of processing elements". It is unclear how the local mean number is defined (i.e. is the mean determined over a sampling interval or determined based on the total number of tasks divided by the number of PE's). Line 11 recites, "calculating a local deviation within each of said plurality of processing elements". It is unclear whether the local deviation determination step is performed based on the preceding step.

iv. Claims 7 and 25 recite, "V". It is unclear what is meant by "V". Claims 5 and 18 also recites, "Er". It is unclear how this value is derived for each of the plurality of processing elements. Claim 7 and 25 also recites, "PEr" without providing a definition.

v. Claims 9 and 26 recite, "wherein Er controls said Trunc function." It is unclear how Er'controls' the function. Furthermore, it is unclear how this step is

possible since each Er value is set ahead of time and must be different for each processing element as stated in claim 8.

vi. Claims 10 and 27 recites, "X and (X+I)". It is unclear what is meant by this. Claims 10 and 27 also recites, "Er" without providing a definition.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1, 18 and 33 is rejected under 35 U.S.C. 102(b) as being anticipated by Wheat(Wheat) US Patent No. 5,630,129.

As per claim 1, Wheat discloses:

- A method for balancing the load of an n-dimensional array of processing elements, wherein each dimension of said array includes said processing elements arranged in a plurality of lines and wherein each of said processing elements has a local number of tasks associated therewith, the method comprising: balancing at least one line of processing elements in a first dimension; balancing at least one line of processing elements in a next dimension; and repeating said balancing at least one line of processing elements in a next

dimension for each dimension of said n-dimensional array (col 2 lines 18-33 and figure 1)

figure one shows the balancing steps from one dimension to the next dimension.

As per claim 18, the rejection of claim 1 is incorporated and further Wheat discloses:

- wherein said balancing each line of processing elements in a first dimension further comprises: selecting one or more lines within said first dimension; and shifting the number of tasks assigned to processing elements in said selected one or more lines (col 4 lines 21-36 and figure 1) figure 1 shows the balancing steps from one dimension to next dimension.

Claim 33 is a memory device claim of claim 1 above. Therefore it is rejected under the same rational.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 2, 3, 4, 6, 11, 16, 17, 19-24 and 32 are rejected under 35 U.S.C. 103(a) being unpatentable over Wheat(Wheat) US Patent No. 5,630,129 in view of "A Simple Load Balancing Scheme for Task Allocation in Parallel Machines"(Rudolph).

As per claim 2, Wheat discloses:

- calculating a total number of tasks for said line, wherein said total number of tasks for said line equals the sum of said local number of tasks for each processing elements on said line (col 5 lines 52-56) total number of tasks are calculated for calculating the average number of tasks.

- calculating a local mean number of tasks for each processing elements on said line (col 5 lines 55-56) average workload is the mean value.

- determining a first local cumulative deviation for each of said plurality of processing elements; determining a second local cumulative deviation for each of said plurality of processing elements (col 12 lines 59-66)

However Wheat does not disclose , ***notifying each of said plurality of processing elements of said total number of tasks***

On the other hand Rudolph discloses:

- notifying each of said plurality of processing elements of said total number of tasks (page 3 col 1 figure 1 lines 1-5) processing elements balancing the loads inherently means knowing the total number of task.

Therefore, it would have been obvious to a person of ordinary skill in art at the time of invention was made to incorporate the teaching of Rudolph into the method of Wheat to notify the processors with the total number of tasks. The modification would have been obvious

because one of the ordinary skills of the art would notify the processing elements with the number of tasks in the system to finite the steps of balancing the system.

Rudolph also discloses:

- calculating a local deviation for each of said plurality of processing elements (page 4 col 1 lines 19-22) finding the difference with the lowest limit(average) is calculating the deviation.

Rudolph also discloses:

- redistributing tasks among said plurality of processing elements in response to said first local cumulative deviation and said second local cumulative deviation. (Page 3 col 1 figure 1 and col 1 lines 19-22) tasks are balanced(redistributed) between processors.

As per claim 3, the rejection of claim 2 is incorporated and further Wheat discloses:

- wherein two or more lines in at least one of said first dimension and said next dimension are balanced in parallel (figure 1 and col 5 lines 47)

As per claim 4, the rejection of claim 2 is incorporated and further Rudolph discloses:

- wherein said calculating a total number of tasks for said line comprises sequentially summing said local number of tasks for each processing elements on said line from a first end of said line to a second end of said line (page 1 col 1 lines 21-24 and col 2 lines 27-30)

As per claim 6, the rejection of claim 2 is incorporated and further Rudolph discloses:

- wherein said notifying step includes passing said total number of tasks from a second end of said line to a first end of said line (page 1 col 2 lines 27-30) finding the global average inherently means checking the load throughout the system.

As per claim11, the rejection of claim 2 is incorporated and further Rudolph discloses:

- wherein said calculating a local deviation for each processing element on said line includes finding a difference between said local number of tasks for each PE.sub.r and said local mean number of tasks for each PE.sub.r. (page 4 col 1 lines 19-22) finding the difference with the lowest limit(average) is calculating the deviation.

As per claim 19, the rejection of claim 2 is incorporated and further Smith discloses:

- wherein said calculating a local deviation, said determining a first local cumulative deviation, said determining a second local cumulative deviation, and said redistributing tasks among said processing elements are repeated until said local deviation, said first local cumulative deviation, and said second local cumulative deviation for each of said processing elements is zero (page 2 paragraph 0027, paragraph 0038 lines 4-12) tasks are redistributed until the system is balanced(zero).

As per claim 20, Rudolph discloses:

- balancing said plurality of lines in one dimension, wherein each of said balanced lines includes PEs with one of X local number of tasks and (X+1) local number of tasks;

substituting the value zero (0) for each processing element having X local number of tasks; substituting the value one (1) for each processing element having (X+1) local number of tasks; shifting said values for each processing element within said balanced lines until a sum of said processing elements relative to a second dimension has only two values. (page 4 col 1 lines 37-44) system threshold value τ is the value of X and values more that τ is X+1. System is being balanced according to the τ value means shifting the task loads.

As per claim 21, the rejection of claim 20 is incorporated and further Wheat discloses:

- balancing said plurality of lines in a next higher dimension; and repeating said balancing said plurality of lines in a next higher dimension for each remaining dimension of said n-dimensional array (col 4 lines 21-36)

As per claim 24, the rejection of claim 22 is incorporated and further Rudolph discloses:

- calculating a local mean number of tasks for each processing element on said line (page 1 col 1 lines 21-24) total number of task divided by the number of processor is the mean value of for processors.

- calculating a local deviation from said local mean number of tasks for each processing element on said line by finding the difference between said local number of tasks and said local mean number of tasks for each processing element on said line (page 4 col 1 lines 19-22) finding the difference with the lowest limit(average) is calculating the deviation.

Claim 23 has the combined limitations of claims 4 and 6 above. It is therefore rejected under the same rational.

Claims 16, 17 and 22 have similar limitations of claims 2 above. They are therefore rejected under the same rational.

Claim 32 has similar limitations of claims 19 above. It is therefore rejected under the same rational.

13. Claims 12-15 and 28-31 are rejected under 35 U.S.C. 103(a) being unpatentable over Wheat(Wheat) US Patent No. 5,630,129 in view of "A Simple Load Balancing Scheme for Task Allocation in Parallel Machines"(Rudolph) and in view of Smith(Smith) US Patent Publication 2004/0024874 A1.

As per claim 12,Wheat and Rudolph substantially discloses the invention as claimed except, ***determining a first local cumulative deviation includes sequentially summing said local deviations for each PE.sub.r from a first end of said line to an adjacent upstream PE.sub.r-1 on said line.***

On the other hand Smith discloses:

- wherein said determining a first local cumulative deviation includes sequentially summing said local deviations for each PE.sub.r from a first end of said line to an adjacent upstream PE.sub.r-1 on said line. (paragraph 0038 lines 4-12)

Therefore, it would have been obvious to a person of ordinary skill in art at the time of invention was made to incorporate the teaching of Smith into the method of Wheat and Rudolph to sequentially adding the local deviation for each PE. The modification would have been obvious because one of the ordinary skills of the art would determine the local deviation to find out the difference between the processing elements workloads to have finite steps for balancing the system task load.

As per claim 13, the rejection of claim 2 is incorporated and further Smith discloses:

- wherein said determining a second local cumulative deviation includes finding a difference between the negative of said local deviation for each PE.sub.r and said first local cumulative deviation for each PE.sub.r. (paragraph 0038 lines 4-12)

As per claim 14, the rejection of claim 2 is incorporated and further Smith discloses:

- wherein said redistributing tasks among said processing elements on said line comprises: transferring a task from a local PE.sub.r to a left-adjacent PE.sub.r-1 if said first local cumulative deviation for said local PE.sub.r is a negative value; transferring a task from said local PE.sub.r to a right-adjacent PE.sub.r+1 if said second local cumulative deviation for said local PE.sub.r is a negative value. (Page 2 paragraph 0027 and 0028) bi-directional link between processors and balancing task going both direction means transferring task to the right or left adjacent processor.

As per claim 15, the rejection of claim 2 is incorporated and further Smith discloses:

- wherein said redistributing tasks among said processing elements on said line comprises: transferring a task from a local PE.sub.r to a left-adjacent PE.sub.r-1 if said second local cumulative deviation for said local PE.sub.r is a positive value; transferring a task from said local PE.sub.r to a right-adjacent PE.sub.r+1 if said first local cumulative deviation for said local PE.sub.r is a positive value. (Page 2 paragraph 0027 and 0028) bi-directional link between processors and balancing task going both direction means transferring task to the right or left adjacent processor.

Claims 28, 29, 30 and 31 have similar limitations of claims 12, 13, 14, and 15 above. They are therefore rejected under the same rational.

14. Claims 7, 8, 9, 10, 25, 26 and 27 are rejected under 35 U.S.C. 103(a) being unpatentable over Wheat(Wheat) US Patent No. 5,630,129 in view of "A Simple Load Balancing Scheme for Task Allocation in Parallel Machines"(Rudolph) and in view of Vignes et al.(Vinges) US Patent No. 4,386413.

As per claim 7, Wheat and Rudolph disclose all the elements of claim 7 except, truncating the mean value.

However Vignes discloses:

- wherein said calculating a local mean number of tasks includes solving the equation M.sub.r=Trunc((V+E.sub.r)/N), where M.sub.r represents said local mean for a local PE.sub.r

on said line, N represents the total number of PEs on said line, and E.sub.r is a number in the range of 0 to (N-1). (col 1 lines 18-27)

Therefore, it would have been obvious to a person of ordinary skill in art at the time of invention was made to incorporate the teaching of Vignes into the method of Wheat and Rudolph to truncate the mean value. The modification would have been obvious because one of the ordinary skills of the art would implement a truncated task value for the system to assign a proper number of threads on the system.

As per claim 8, the rejection of claim 7 is incorporated and further Rudolph discloses:

- wherein each processing element has a different E.sub.r value. (figure 1)

As per claim 9, the rejection of claim 7 is incorporated and further Vignes discloses:

- wherein E.sub.r controls said Trunc function such that said total number of tasks for said line is equal to the sum of the local mean number of tasks for each processing element on said line (col 2 lines 36-43)

As per claim 10, the rejection of claim 7 is incorporated and further Rudolph discloses:

- wherein said local mean M.sub.r=Trunc((V+E.sub.r-)/N) for each local PE.sub.r on said line is equal to one of X and (X+1) (page 4 col 1 lines 37-39) balancing the system with a threashold value(x) means having task value of x and x+1.

Claims 25, 26 and 27 have similar limitations of claims 7, 9 and 10 above. They are therefore rejected under the same rational.

15. Claim 5 is rejected under 35 U.S.C. 103(a) being unpatentable over Wheat(Wheat) US Patent No. 5,630,129 in view of "A Simple Load Balancing Scheme for Task Allocation in Parallel Machines"(Rudolph) and in view of "Calculus" (Thomas).

As per claim 5, Wheat in view of Rudolph discloses all the elements of claim 5 except, ***includes solving the equation 6 V = i = 0 i = N - 1 v i ,where V represents said total number of tasks for said line, N represents the number of processing elements on said line, and v.sub.i represents said local number of tasks for a local PE.sub.r on said line.***

However Thomas discloses:

wherein said calculating said total number of tasks for said line includes solving the equation 6 V = i = 0 i = N - 1 v i ,where V represents said total number of tasks for said line, N represents the number of processing elements on said line, and v.sub.i represents said local number of tasks for a local PE.sub.r on said line. (page 568)

Therefore, it would have been obvious to a person of ordinary skill in art at the time of invention was made to incorporate the teaching of Thomas into the method of Rudolph and Wheat to solve the equation of average value of the total number of task. The modification would have been obvious because one of the ordinary skills of the art would implement a summation equation to solve the mathematical problem.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

TITLE: Method and apparatus of providing a result of a numerical calculation with the number of exact significant figures; US Patent No. 4,386,413.

TITLE: Processor with load balancing; US Patent Publication No. 2004/0024874 A1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abdullah-Al Kawsar whose telephone number is 571-270-3169. The examiner can normally be reached on 7:30am to 5:00pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chameli Das can be reached on 571-272-3696. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AK

JEAN M. CORRIELUS
PRIMARY EXAMINER
Art Unit 2162
Date 9/15/07